CLAIMS

1. A carrier phase GPS positioning device, comprising:

a first integer ambiguity estimation unit that associates variance data in a first duration extracted from data received from a satellite by a reference station at a fixed position, with data received from the satellite by a mobile station in a second duration shorter than the first duration, and estimates an integer ambiguity included in a carrier phase accumulation value of signals transmitted from the satellite received by the mobile station; and

a positioning unit that determines the position of the mobile station using the integer ambiguity estimated by the first integer ambiguity estimation unit.

2. The carrier phase GPS positioning device as claimed in claim 1, wherein abnormal values are excluded from the variance data.

3. The carrier phase GPS positioning device as claimed in claim 1, wherein when reception of an electromagnetic wave emitted from the satellite is temporarily interrupted, data prior to the interruption is excluded from the variance data.

4. The carrier phase GPS positioning device as claimed in claim 1, wherein

the variance data in the first duration includes a plurality of carrier phase accumulation values of the signals transmitted from the satellite at a first number of times in the first duration; and

the first integer ambiguity estimation unit
associates the carrier phase accumulation values on the
reference station side at the first number of times, with
a plurality of carrier phase accumulation values on the
5   mobile station side at a second number of times, and
estimates the integer ambiguity included in the carrier
phase accumulation values of the signals transmitted from
the satellite received by the mobile station, said second
number being less than the first number.
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5. The carrier phase GPS positioning device as
claimed in claim 3, wherein
the variance data in the first duration
includes a plurality of carrier phase accumulation values
15   of the signals transmitted from the satellite at a first
number of times in the first duration; and
the first integer ambiguity estimation unit
associates the carrier phase accumulation values on the
reference station side at the first number of times, with
20   a carrier phase accumulation value on the mobile station
side at one time, and estimates the integer ambiguity
included in the carrier phase accumulation value of
signals transmitted from the satellite received by the
mobile station.
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6. The carrier phase GPS positioning device as
claimed in claim 3, wherein after the first integer
ambiguity estimation unit estimates the integer ambiguity,
the positioning unit determines the position of the
30   mobile station using data measured on the mobile station
side alone.

7. The carrier phase GPS positioning device as

claimed in claim 4, further comprising:

a movement quantity detection unit that
detects a movement of the mobile station and a movement
quantity of the mobile station when the mobile station is
5   moving;

a second integer ambiguity estimation unit
that, when the mobile station is at rest, estimates the
integer ambiguity included in the carrier phase
accumulation value of the signals transmitted from the
10   satellite received by the mobile station, said estimation
being made based on a plurality of carrier phase
accumulation values on the reference station side and a
plurality of carrier phase accumulation values on the
mobile station side at a plurality of times in the period
15   when the mobile station is at rest; and

a third integer ambiguity estimation unit that,
while the mobile station is moving, estimates the integer
ambiguity included in the carrier phase accumulation
value of the signals transmitted from the satellite
20   received by the mobile station while taking movement
quantity detection results into consideration.

8. The carrier phase GPS positioning device as
claimed in claim 7, wherein
25   after the second integer ambiguity estimation
unit or the third integer ambiguity estimation unit
estimates the integer ambiguity, the positioning unit
determines the position of the mobile station using the
integer ambiguity estimated by the second integer
30   ambiguity estimation unit or the third integer ambiguity
estimation unit instead of the integer ambiguity
estimated by the first integer ambiguity estimation unit.

9. The carrier phase GPS positioning device as claimed in claim 7, wherein

the mobile station is a vehicle having wheels;

the movement quantity detection unit detects a

5   movement of the vehicle based on a wheel speed sensor
that detects a rotational speed of the wheels;

when a slip ratio greater than a predetermined
value is detected by at least the wheel speed sensor, the
integer ambiguity estimation processing by the third

10   integer ambiguity estimation unit is initialized, and the
positioning unit determines the position of the mobile
station using the integer ambiguity estimated by the
first integer ambiguity estimation unit until the third
integer ambiguity estimation unit estimates or re-

15   estimates the integer ambiguity.

10. The carrier phase GPS positioning device
as claimed in claim 1, wherein

when a plurality of reference stations is

20   present in a communication region, the reference station
is selected which is able to communicate with more
satellites in common with the satellite communicating
with the mobile station, and

the variance data related to the selected

25   reference station is used.

11. The carrier phase GPS positioning device
as claimed in claim 10, wherein

when there are plural of the reference

30   stations able to communicate with the same number of the
satellites, the reference station is selected which has
the highest minimum reception strength of signals from
the satellites.

12. The carrier phase GPS positioning device as claimed in claim 1, wherein

when a plurality of reference stations, which

5   receives signals from a plurality of common satellites and the signal reception strength with each of the common satellites exceeds a predetermined value, is present in a communication region, the reference station is selected which is closest to the mobile station, and

10   the variance data related to the selected reference station is used.

13. A carrier phase GPS positioning method, comprising the steps of:

15   associating variance data in a first duration extracted from data received by a reference station at a fixed position from a satellite, with data received from the satellite by a mobile station in a second duration shorter than the first duration, and estimating an

20 integer ambiguity included in a carrier phase accumulation value of signals transmitted from the satellite received by the mobile station; and

    determining the position of the mobile station using the estimated integer ambiguity.

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14. A carrier phase GPS positioning method, comprising the steps of:

    acquiring a carrier phase accumulation value at one time on the mobile station side;

30   acquiring a plurality of carrier phase accumulation values at a plurality of times prior to the one time on the reference station side;

    associating the carrier phase accumulation

values on the reference station side at the plural times,
with a carrier phase accumulation value on the mobile
station side at the one time, and estimating an integer
ambiguity included in the carrier phase accumulation
5   value of signals transmitted from the satellite received
by the mobile station.

         15.   A carrier phase GPS positioning system,
comprising:
10   a reference station that extracts variance
data in a first duration based on received data from a
satellite;
          a carrier phase GPS positioning device
including a first integer ambiguity estimation unit that
15   associates the variance data with data received from the
satellite by a mobile station in a second duration
shorter than the first duration, and estimates an integer
ambiguity included in a carrier phase accumulation value
of signals transmitted from the satellite received by the
20   mobile station; and a positioning unit that determines
the position of the mobile station using the estimated
integer ambiguity; and
          a communication path that enables
communication between the carrier phase GPS positioning
25   device and the reference station.

         16.   A reference station that extracts
variance data in a predetermined duration based on
received data from a satellite, and transmits the
30   variance data to a carrier phase GPS positioning device
including an estimation unit that associates the variance
data with data received from the satellite by a mobile
station, and estimates an integer ambiguity included in a

carrier phase accumulation value received by the mobile station from the satellite; and a positioning unit that determines the position of the mobile station using the estimated integer ambiguity.

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17.   A reference station, comprising:

an acquisition unit that acquires a carrier phase accumulation value at one time on a mobile station side;

10   an integer ambiguity estimation unit that associates a plurality of the carrier phase accumulation values at a plurality of times prior to the one time on the reference station side, and estimates an integer ambiguity included in the carrier phase accumulation

15 value of signals transmitted from the satellite received by the mobile station;

a positioning unit that determines the position of the mobile station using the integer ambiguity estimated by the integer ambiguity estimation

20 unit; and

a transmission unit that transmits the position detected by the positioning unit to the mobile station.

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